DISTRIBUTION AND HABITAT OF THE FALSE WATER RAT, *XEROMYS MYOIDES* THOMAS, 1889 (RODENTIA:MURIDAE) IN INTERTIDAL AREAS OF CENTRAL EASTERN QUEENSLAND

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The distribution and habitat preference of *Xeromys myoides* was determined by trapping and searching intertidal habitats along the coastline of central Queensland, between Cannonvale and Cape Palmerston National Park. Patchy evidence of *Xeromys myoides* was found along the full extent of coastline investigated, suggesting that the species may have a wider distribution than previously thought. In the study area, however, the species appeared to be largely restricted to mangrove communities dominated by *Ceriops tagal* and/or *Bruguiera* spp. where it was nevertheless rare, suggesting that complex factors influence its distribution. Nesting appeared to be restricted to tall closed forest dominated by *Ceriops tagal* and *Bruguiera* spp, and adults were more commonly captured in this community. *X. myoides* appeared to inhabit only a small portion of available intertidal habitats within the study area. ❒ *Xeromys myoides, false water rat, central Queensland, habitat, intertidal areas.*

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The false water rat, *Xeromys myoides* is a small, specialised rodent that has been found in coastal intertidal wetlands and some adjacent habitats (Thomas, 1889, McDougall, 1944; Redhead & McKean, 1975; Magnusson et al., 1976; Van Dyck et al., 1979; Van Dyck & Durbidge, 1992; Van Dyck, 1996). It occurs in apparently disjunct coastal populations in Queensland, the Northern Territory and Papua New Guinea (Van Dyck, 1995; Hitchcock, 1998). Although the species' habitat is essentially wetlands, its habits are not truly aquatic (Watts & Aslin, 1981). On North Stradbroke Island (southeastern Queensland) *X. myoides* is an active predator on marine invertebrates, particularly grapsid crabs (Van Dyck, 1996). Magnusson et al. (1976) reported it feeding on marine crabs in the Northern Territory. Several key records of *X. myoides* have been made accidentally e.g. at Melville Island, during estuarine crocodile surveys (Magnussen et al., 1976) and at Myora Springs, North Stradbroke Island (Van Dyck & Durbidge, 1992). Given its habitat and dietary preferences, *X. myoides* is unlikely to be detected by most small mammal survey techniques. Its apparent rarity may be a reflection of this (Van Dyck, 1996; Watts & Asplin, 1981).

The species is listed as vulnerable (Anon, 1994, 1999), however, a recent review of the conservation status of native rodents in Queensland (Dickman et al., 2000) proposes that *X. myoides* be considered endangered due to its apparently small population size, downward trends in abundance and distribution, and presence of threatening processes.

Mackay, (in central eastern Queensland), is the type locality for *X. myoides* (Thomas, 1889). Additional records for Mackay were reported in 1944 by McDougall and in 1982 (Anon.) from Proserpine. The only recently recorded capture within the study area was of a single animal south of Mackay in 1998 (Van Dyck, unpublished data). Several early records were obtained from freshwater sedgelands adjacent to intertidal areas. Within the study area these habitats are now rare, often weed infested and geographically restricted due to land development.

Van Dyck (1996) recorded that no significant foraging by *X. myoides* took place within freshwater habitats on North Stradbroke Island. Given this, freshwater areas were not considered within the current study which aimed to clarify current patterns of distribution and broad habitat utilisation within intertidal habitats in central Queensland (Fig. 1).

MATERIALS AND METHODS

A broad analysis of intertidal communities and their geographical extent in the study area was performed using available intertidal vegetation

mapping (Anon, 2002). Potential habitat of *X. myoides* within the study area was identified using descriptions of known habitat on North Stradbroke Island (Van Dyck, 1996), and central Queensland communities considered to provide suitable habitat by Steve Van Dyck, (pers comm, 1998). A capture of *X. myoides* within the study area by VanDyck immediately prior to this study, assisted initial habitat identification. Mapping of mangrove communities within the study area (Winter & Wild, 1995) and aerial photography were used to select a sample of accessible mangrove communities for field inspection. The vegetation at each site was allocated to one of 7 types. These vegetation types make up 99% of the inter-tidal vegetation communities in the area.

Selected sites were investigated during January-October 1999. Each site was intensively searched for nesting and/or feeding signs of *X. myoides*. Site searches extended approximately 100m in radius around a given point on the supra-littoral margin of the mangrove community. Field inspections sought to locate termitarium-like mounds (Van Dyck (1992, 1996; Van Dyck & Gynther, 2003), mounds associated with buttress roots (Magnusson et al., 1976) and simple tunnels built into supralittoral banks (Van Dyck, 1996). Structures thought to be nests were carefully probed with light gauge wire or mangrove twigs (diameter <5mm) to determine if they contained hollows that could have been nesting chambers or burrow complexes. Hollow sections within such structures could be readily felt by a reduction in pressure needed to insert probes. Nesting structures were also tentatively attributed to *X. myoides* if feeding middens were located near entrance burrows or in close association with a suspected mud structure. Caution was taken to avoid confusing *X. myoides* nests with other mud structures such as those constructed by the mangrove lobster (*Thalassina anomala*) or other mangrove crustaceans, or with deposits of mud naturally accumulated around mangrove tree roots by hydrological action.

Field searches concentrated largely on locating the remains of grapsid crabs having a carapace width of up to approximately 20mm (Van Dyck, 1996).

Searches also focussed on locating 'middens' composed of decapod remains attributable to *X. myoides*. Some middens containing the partially crushed remains of the mud whelk, *Telescopium telescopium* were attributed to the much larger *Hydromys chrysogaster* or the Black Rat (*Rattus rattus*). Middens that contained significantly damaged, heavy crab carapace or appendages (especially claws) were also attributed to *H. chrysogaster* or *R. rattus*. Searches for feeding signs were made between the level of highest astronomical tide and low water level, preferably during neap tidal cycles.

FIG. 1. Study area covering intertidal habitats in central-eastern Queensland, form Cannonvale to Cape Palmerston.

Spotlighting, using low powered lights (Petzl 4.5v headlamps with standard bulb and/or 30 watt handheld spotlights) was abandoned as a cost-effective survey technique with only one animal observed for 32 person hours searching. No tracks or trackways could be attributed to *X. myoides*.

Sites inspected were classified according to the evidence of *X. myoides* present. Class 1 sites contained structures assumed to be nests. Class 2 sites contained feeding remains that may have been left by *X. myoides* but no nest structures. Class 3 sites contained no evidence of the presence of *X. myoides*. Trapping was conducted within a sample of Class 1 sites to confirm the presence of *X. myoides*. One locality containing Class 2 sites was trapped extensively in response to a sighting of *X. myoides* while spotlighting. A selection of Class 2 and 3 sites was also trapped regardless of assumptions based on signs observed. The latter sites were selected as a sample of different mangrove communities occurring within the study area.

TABLE 1. Major inter-tidal vegetation communities within the study area.

Vegetation Community	Percentage Extent within the Study Area
Closed shrub-land of *Aegiceras corniculatum*. This community is rare within the study area and typically occurs as a thin linear fringe on the landward side of other communities.	< 1%
Open to closed forest of *Avicennia marina*. This community occurs at both landward and seaward margins, and is often structurally variable at any given location.	3%
Open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. Two forms of this community are readily recognised. One forms a tall (to 12m) forest near the supralittoral zone and tends to contain *Bruguiera* spp. as co-dominants or rarely, dominant canopy species. The second is a low open to closed forest or shrub-land occurring near the supralittoral margin, or on low rises surrounded by saltpan.	25%
Mixed species closed forest.	13%
Closed forest of *Rhizophora* spp, typically *R. stylosa*. These forests typically occur on seaward margins or in areas close to, or within regular tidal flows.	31%
Saline grassland (dominated by *Sporobolus virginicus*). Saline grasslands are typically supralittoral communities that grade into adjacent samphire flats and/or terrestrial vegetation.	3.5%
Salt-pan and samphire flats. The level to which salt-pans are vegetated by samphire is highly variable and in many areas no vegetation is present.	23%

Type A 'Elliot' traps were baited with halved Western Australian pilchards and placed in the intertidal zone. Traps were typically placed alongside fallen timber, amongst buttress roots and inside fallen logs. Traps were also placed near nests or middens. A trap-line consisted of 20 traps placed approximately 10m apart. Trap-lines were located to ensure that all structural and floristic variants of the mangrove community were sampled. Typically traps were located parallel to the coastline and between the supra-littoral zone and the low water mark. Thin white cotton string was laid along the trap line at waist height to facilitate easy recovery of the traps. All sites were trapped for a minimum of four nights with a minimum of one trap-line (ie 80 trap nights) unless a capture was made earlier. Actual number of traps used was dictated by size of the site. Preference was given to setting trap-lines around daytime high tides when following night high tide levels were lower. This approach greatly reduced the risk of inundation and drowning of captured animals. In some cases it was possible to accurately gauge the likely extent of the night high tide by examining the level of ground moistened by previous tides.

All animals caught were weighed, and measured. Each animal was assigned to an age class on weight, and sexed on anal-urogenital distance (Van Dyck, 1996). Each animal was then immediately released at the point of capture and its behaviour observed.

RESULTS

The study area contains approximately 39,384 hectares of inter-tidal vegetation communities (Anon, 2002). Approximately 99% falls into 7 readily recognizable types (Table 1). During January 1999 and October 1999 125 sites at 35 localities were inspected for signs of *X. myoides*. Each site was allocated to one of 7 vegetation types. No evidence of 'termitaria' type nesting structures was observed at any site. Nesting structures attributed to *X. myoides* consisted of mud ramps constructed between the buttress roots of *Ceriops tagal* or more commonly *Bruguiera* spp. Nests were observed on living trees, dead standing trees and occasionally, stumps or large root masses which had toppled over. Nests sometimes exhibited fresh plastering of mud on their surfaces and often-contained fragments of small crab shell. Often, a number of tunnels with oval-shaped entrances (Van Dyck, 1996) lead into the nest. No ramp was greater than 60cm high. Feeding signs of *X. myoides* typically consisted of clean, disarticulated dorsal crab carapace (Grapsidae) No crab carapace wider than 30mm was found and most were less than 20mm. Other remains of the crab including uneaten appendages often lay close by. Middens consisting of several crab remains were often observed at the base of presumed nesting structures, in sheltered areas between mangrove buttress roots, within hollow logs or adjacent to fallen timber.

Three of the 7 communities were assigned to Class 3 (i.e. no sign of *X. myoides*). These were closed forest of *Rhizophora* spp., closed shrub-land of *Aegiceras* corniculatum, and saltpan/samphire flats. It was concluded that *X. myoides* did not utilise these communities and they were not targeted for trapping. However, given that inside closed forest of *Rhizophora* spp. feeding remains might have been regularly removed or obscured by daily tidal flows, two sites were selected for trapping. This trapping did

TABLE 2. Vegetation types surveyed, classified and trapped.

Community	Time of Survey	No. Sites Inspected	Site Class	No. Sites Trapped	Total Trap Nights
Closed shrub-land of *Aegiceras corniculatum*	May – June 1999	7	3	0	0
Open to closed forest of *Avicennia marina*	Jan - Oct 1999	15	2/3	6	1,289
Open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. (tall forest)	Jan – Aug 1999	26	1/2/3	8	490
Open to closed forest of Ceriops tagal +/- *Bruguiera* spp. (low forest)	Apr – Aug 1999	7	1/2/3	5	340
Mixed species closed forest	Jan – October 1999	31	3 rarely 2	2	200
Closed forest of *Rhizophora* spp.	Jan – July 1999	25	3	2	200
Saline grassland	March – May 1999	9	1/3	1	120
Salt-pan and samphire flats	March-May 1999	5	3	0	0
Totals	Jan – October 1999	125		24	2,639

not result in any captures. Three communities were assigned to Class 2 (contained feeding evidence). These were saline grassland, mixed species closed forest, and open to closed forest of *Avicennia marina*. Areas of saline grassland contained signs on only one occasion at 1 of the 9 sites inspected. The grassland at this site was adjacent to a closed forest of *Ceriops tagal* that contained signs both of feeding and nesting. This was the only grassland site trapped. Of the 31 sites containing mixed species closed forests (Table 2), only 2 contained signs attributable to *X. myoides*. Both these sites were trapped. Open to closed forests of *Avicennia marina* contained feeding signs attributable to *X. myoides* at 8 of the 15 sites. One individual was observed while spotlighting in March 1999. Six of the 8 sites that contained feeding signs were trapped, and additional time (31 person hours) was spent spotlighting at the locality where the previous sighting was made. The only community that was allocated to Class 1 (nesting sign present) was closed forest of *Ceriops tagal* +/- *Bruguiera* spp. Although nests were present within both forms of this community, they were more common in tall forests (11 of 26 sites) than in low forests (2 of 7). However, within these communities it was also common to find no nesting sign (15 of 26 sites, and 5 of 7, respectively). Some areas of this community contained no sign attributable to *X. myoides* (5 of 26, and 2 of 7 sites, respectively). Eight tall forests and 5 low forests were trapped.

A total of 2,639 trap nights was spread over 24 sites (Table 3). Captures were usually made on the first night (8 of 11 sites) and on only one occasion (Dunrock West 1) did it take more than two nights for the first capture. Most captures were made within Class 1 sites of tall open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. The exceptions were one capture at a Class 2 site, a low open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. (Cape Palmerston 2) and one capture at a Class two, saline grassland site (Dunrock west 1) One tall open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. (Class 2) and 2 low open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. (Class 2) sites did not yield captures. 1,089 of the 1,289 trap nights in *Avicennia marina* open to closed forest took place at 4 sites within approximately 500m of the spotlighting sighting made in March 1999. In addition, no more sightings of *X. myoides* were made despite 31 person hours of search effort.

The 11 successfully trapped sites yielded 21 animals from 630 trap nights. One animal perished from unknown causes and was forwarded to the Queensland Museum (JM 13850). *X. myoides* was the only small mammal caught. Cane toads (*Bufo marinus*) were captured in small numbers. Although animals were most often captured in the first night, trap success was low, typically; less than 3%. An outstanding exception was the site Freshwater Point East 1, which yielded 10 animals from 40 traps in the first night (i.e. 25% trapping success).

Adults were captured at 5 of 11 sites. 7 of 10 animals captured at Freshwater Point East were adults (4 males, 3 females). All were caught in a 3ha block of habitat (total area < 8ha) surrounded by habitat presumed unsuitable for the species (dry terrestrial vegetation, saltpan and built infrastructure including a sealed road).

Fourteen females and six males were captured in addition to one unsexed individual (Table 4). Pilchard baits were, in most cases, almost fully

TABLE 3. Sites trapped to confirm or otherwise presence of *X. myoides*.

Community	Site/ Site Class	Timing	Trap nights	Captures	Night of capture
Open to closed forest of *Avicennia marina*	Barnes Creek Road East 1 / 2	Jan 1999	429	nil	
	Barnes Creek Road East 2/ 2	Mar 1999	160	nil	
	Barnes Creek Road West 2/ 2	Mar 1999	240	nil	
	Dolphin Heads/ 2	Apr 1999	60	nil	
	Barnes Creek Road West 1/ 2	Jun 1999	260	nil	
	Andergrove / 2	Oct 1999	120	nil	
Open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. (tall forest)	Dunrock West 1/ 1	Mar 1999	120	1	3rd
	Freshwater Point East/ 1	Jun 1999	40	10	1st
	Cape Palmerston 1/ 1	Jun 1999	60	1	2nd
	Proserpine River/ 1	Jul 1999	40	1	1st
	Waite Creek/ 1	Jul 1999	40	1	1st
	Eimeo 1/ 1	Aug 1999	40	1	1st
	Bucasia 1/ 2	Aug 1999	120	nil	
	Bucasia 2/ 1	Aug 1999	40	2	1st
Open to closed forest of *Ceriops tagal* +/- *Bruguiera* spp. (low forest)	Bakers Creek 1/ 2	Mar 1999	60	nil	
	Smalley's Beach/ 1	Apr 1999	40	1	1st
	Cape Palmerston 2/ 2	Jun 1999	60	1	1st
	Freshwater Point West 2/ 1	Jun 1999	40	1	1st
	Eimeo 2/ 2	Aug 1999	120	nil	
Mixed species closed forest	Bakers Creek 2/ 2	Mar 1999	60	nil	
	Andergrove 2/ 2	Oct 1999	120	nil	
Closed forest of *Rhizophora* spp.	Funnel Bay/ 3	May 1999	120	nil	
	Shute Harbour/ 3	May 1999	80	nil	
Saline grassland	Dunrock West 2/ 2	March 1999	120	1	1st

consumed by trapped animals. The fleshy fillets either side of the spine were consumed by captive animals leaving the fine skeletal structures neatly intact. Released animals quickly entered tunnels associated with nests or found refuge in crab holes.

DISCUSSION

The study area contains approximately 39,384ha of inter-tidal vegetation largely dominated by mangrove communities and associated saline grasslands. A number of studies in other regions, notably the benchmark work of Van Dyck (1996), found these communities to be suitable habitat for *X. myoides*. In this study *X. myoides* was, with few exceptions only captured within open to closed forests of *Ceriops tagal* +/- *Bruguiera* spp. Although the species was trapped once within an area of marine couch, a closed forest of *Ceriops tagal* and *Bruguiera* spp. abutted it and traps were laid less than 20m from the mangrove forest. Despite site surveys and in addition to incidental observations made over 9 months, no sign of *X. myoides* (either nesting or feeding) was found within marine couch saltmarsh.

A single individual was observed within a closed forest of *Avicennia marina*. However, despite intensive searching and trapping, no additional records were obtained in *A. marina* forest. Van Dyck (1994) noted that *X. myoides* could travel relatively large distances at night (up to 2.9km). As such, the animal observed may not have actually resided in the *A. marina* forest. It appears that on the central Queensland coast; open to closed forests of *Ceriops tagal/Bruguiera* spp. form the core habitat of *X. myoides*. This vegetation type makes up approximately 25% (approx. 9,887ha) of the geographical extent of inter-tidal vegetation in the study area. However, not all of the open to closed forests of *Ceriops tagal/ Bruguiera* spp surveyed were found to be inhabited by *X. myoides*. Site surveys yielded no evidence of the species within some forests of this type, and trapping failed to capture animals on a number of occasions even when feeding signs (but not nesting signs) were evident. While in most cases, no obvious impacts on the

TABLE 4. Details of animals caught by this study.

Site	Weight (gm)	Tail (mm)	Body (mm)	Foot (mm)	Ear (mm)	Anus- urogenital pouch (mm)	Sex	Ad/ Juv/ SubAd
Dunrock West 2	30	85	77	25	8.8	8.0	f	Ad
Dunrock West 1	Not rec.							
Smalley's Beach	29.5	75.5	105.5	23.7	8.3	8.0	f	Subad
Cape Palmerston 2	22	62.5	77.5	22	9.1	14.4	m	Juv
Cape Palmerston 1	30	73.9	104.3	22.6	7.3	8.0	f	Subad
Freshwater Point East	31	80.5	92.4	23.9	8.8	8.6	f	Subad
Freshwater Point East	30	73.9	87.9	23	8.8	5.9	f	Subad
Freshwater Point East	51	94.3	108.3	24.1	8.3	18.9	m	Ad
Freshwater Point East	37	73.3	105	24	7.7	14.4	m	Ad
Freshwater Point East	46	84.4	105.4	23.2	8.8	8.0	f	Ad
Freshwater Point East	31	87.3	105.5	21.9	7.1	14.4	m	Ad
Freshwater Point East	38	85.4	111	22.6	8.8	8.0	f	Ad
Freshwater Point East	55	86.2	114	24.4	8.5	20.1	m	Ad
Freshwater Point East	31	84.4	112.2	23.1	7.1	9	f	Ad
Freshwater Point East	30	78.4	89.8	23.1	7.3	12.5	m	Subad
Freshwater Point West 2	46	81.5	103.2	23	7.5	8.0	f	Ad
Proserpine River	25	68.3	86.2	21.7	7.7	7.9	f	Juv
Waite Creek	24	71.1	80.9	20.0	6.5	6.8	f	Juv
Eimeo 1	44	80	99.6	22.9	9.3	8.1	f	Ad
Bucasia 2	51	94.5	104	23.1	9.1	8.1	f	Ad
Bucasia 2	37	71.2	103.6	22.9	8.9	8.9	f	Ad

mangrove forest were evident, clearing of vegetation to the mangrove edge, alteration of overland water flows (i.e. concentration of stormwater run-off from adjacent urban areas) and disposal of rubbish, were obvious.

The absence of *X. myoides* captures when feeding signs are present is not without precedent. Local extinctions have been reported elsewhere; Hobson (pers comm) on Fraser Island and on the central Queensland coast (Ball & Ball pers obs). Conversely, capture of animals in areas where previous trapping surveys yielded nothing has been reported by Woinarski et al. (2000). The possible reasons for such temporal changes in distribution remain unclear.

This study can throw limited light on the preference of *X. myoides* for closed forests of *Ceriops* tagal +/- Bruguiera spp, or the finer scale distributional patterns within this community. Lee (1998) noted that grapsid crabs are generally more abundant at the supralittoral zone and Woinarski et al. (2000) suggested that the crabs may affect local distributional patterns. On the central Queensland coast, *Ceripos tagal* and/or *Bruguiera* spp typically dominate this zone. Although quantitative surveys were outside the scope of this study, casual observations indicate a difference in crab populations (demonstrated by the density of crabholes) between various sites even within the same mangrove community. There may be a link between the size of grapsid crab populations and presence of *X. myoides* in the study area. There may be dietary preference by *X. myoides*, for a particular species or assemblage of species. Grapsid crabs are important consumers of mangrove propagules (Smith et al., 1991) with each species of crab having a dietary preference for the propagules of particular mangrove species (Lee, 1998). The number of grapsid crabs is therefore likely to be higher in mangrove communities that are actively producing propagules, and some species may be more numerous in some mangrove communities. *X. myoides* distribution patterns between and within communities may reflect seasonal changes in habitat value.

Nesting strategies employed by *X. myoides* in the central Queensland do not appear to include the termitaria type nests ascribed to the species elsewhere. Despite intensive searches, no termitaria like nesting structures were positively identified by this study. Instead it appears that *X. myoides* in central Queensland uses mud ramp

nests constructed amongst buttress roots of mangrove trees. Mud ramp nests were only observed in association with buttress roots of *Ceriops tagal*, and more commonly, *Bruguiera parviflora* or *B. gymnorrhiza*. Several mud ramp nests observed were almost identical, at least from the outside, to that described by Magnusson et al. (1976). However, some were not as distinctive and only breaching the nest would have confirmed its use by *X. myoides*. No other nesting strategies were detected within the study area, although nests constructed inside supra-littoral banks via simple tunnels may easily have gone unnoticed. Reasons for the difference in nest types between central Queensland and elsewhere are unclear. However, the moist wallum, heath, sedgeland and freshwater influences along mangrove ecotones (Van Dyck, 1996), were not present to any large degree at any sites where captures were made in this study. Instead, there was typically a sharp and distinct ecotone between mangroves and dry sclerophyll woodlands and/or saltpan. Van Dyck (1996) suggested that *X. myoides* has a need to dissipate excess heat and may do so by occupying saturated nesting mounds, and by 'puddling' during foraging excursions. Where *X. myoides*, occurs in central Queensland, the only areas in which a nest could remain saturated, or even moist, is within the mangrove forest. Alternatively, construction of mud ramp nests may be an energy saving strategy. Mud ramp nests were always observed associated with buttress roots that effectively formed at least one side of the nest. Presumably, using an existing structure as the basis of a nest would decrease the amount of energy required for its construction and maintenance.

Van Dyck (1996) recorded a mean trapping success rate of 11.7% on North Stradbroke Island. With the notable exception of the apparently aberrant site, (Freshwater Point East @ 25%) trapping on the central Queensland coast averaged only a 1.86% success rate. One possible reason for this may be that habitats within central coastal Queensland may not be as densely populated as those on North Stradbroke Island, and/or that home ranges may be larger in central Queensland.

Although data are limited, initial indications are that tall closed forests of *Ceriops tagal/ Bruguiera* spp. represent preferred habitat for adults as they more often contain nests. Most captures of adults took place within these tall forests. Low forest of *Ceriops tagal/ Bruguiera* spp. rarely contained nests and trapping resulted in only one adult capture.

All animals captured fell into size and weight ranges described for North Stradbroke Island (Van Dyck, 1996). Larger males also had faint 'spotting' similar to that described. With the exception of patterns of habitat use and nesting, there appears to be no obvious behavioural or morphological differences between *X. myoides* in central Queensland and other areas. Patterns of habitat use, and nesting strategies, in central Queensland are considered local adaptations to ecological and physiographical features. Because of the difficulty in consistently recognising nests and the ambiguity of feeding signs, observational site survey alone is not considered to reliably confirm the presence of the species in central Queensland although observational site surveys may be useful elsewhere.

IMPLICATIONS FOR CONSERVATION

Previous studies, notably that of Van Dyck, (1996) suggest that *X. myoides* can make use of a wide range of intertidal habitats. However, this study found that, in central Queensland, the species makes significant use of only 25% of available intertidal habitat. The habitats used are most often directly adjacent to terrestrial areas that are subject to ongoing disturbance, modification and clearing, aquaculture and housing. The downstream effects of these changes on mangrove communities and *X. myoides* are not yet quantified but remain a significant concern. Feral pigs, foxes and both feral and domestic cats are common throughout the central Queensland coast and their impact, as predators on *X. myoides*, is likely to be significant. *X. myoides* was found throughout the study area. Similar habitat to that within the study area extends further north and south. It is therefore highly likely that the range of the species, within central Queensland will be extended with further survey effort. However, it appears that the species occurs in low numbers within only a small portion of broadly suitable habitat. There seems to be little justification for downgrading the species' threatened status.

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